ENTOMOLOGY

Project title: Butterflies of Greater Yellowstone: Aquatic Insects of Greater Yellowstone

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Objective: In conjunction with two courses taught for the Yellowstone Institute at Lamar Ranch one week in early July 2000, sample butterflies and aquatic insects in the northern sector of YNP, and from Gardiner, Montana to Beartooth Summit. Specimens to be collected from meadows, fields, and ponds and small streams (catch and release only).

Findings: Butterflies representing six of the seven families of *Rhopalocera* were identified. These observations included two species of *Papilionidae* (including numerous parnassians), several species of *Pieridae, Satyridae, Nymphalidae, Lycaenidae, Hesperiidae* (sixteen species). A special effort was undertaken to identify the Yellowstone Checkerspot butterfly in the northern region, but none were found. Sex ratio information collected for parnassians indicated a predominance of males (16 males-to-4 females on the backroad to Gardiner) as noted in previous years. Samples of aquatic insects collected from various streams and glacial ponds in the northern region were similar in species composition and diversity to collections made in previous years, with approximately eight species of *Trichoptera*, several species of *Plecoptera*, about six species of *Ephemeroptera*, plus varied species of *Odonata* and aquatic *Diptera*. All specimens obtained in the park were released at point-of-capture following in-field discussions.

A special project undertaken for the Advanced Butterflies course offered through the Yellowstone Institute involved a mark/recapture study of *Parnassius phoebus*. The objective of this study was to teach the methods and value of such endeavors, using the Parnassian model and opportunity. The study was conducted from July 7 through July 22. A total of 40 *P. phoebus,* mostly males, were captured, marked/numbered and released on July 7 and 8, and from July 7 through July 22 some of these marked/numbered individuals were recaptured and released daily, some up to about 200 meters from the point of original capture. The capture/recapture information was incorporated into appropriate indices and ratios, and suggested the total size of the population of these butterflies behind the ranger station at Buffalo Ranch to be about 56 individuals on July 7, 64 individuals on July 8, and 106 individuals July 9, followed by a gradual increase to approximately 180 total butterflies when the study was terminated on July 22. Several of the numbered specimens were recaptured on more than one occasion, and the recapture data indicate these butterflies can live at least 15+ days as adults.

Project title: Butterflies of Yellowstone and Grand Teton National Parks

Principal investigator: Mr. Richard Lund
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Additional investigator(s): Mardell Moore

Objective: To produce field guides about the insects of Yellowstone and Grand Teton national parks. Photographs need to be taken of all species in the parks. Data and photos only need to be obtained. No specimens are collected. All specimens are safely netted, photographed and released live in the area of the park where discovered by the researchers.

Findings: In 2000, several more photographs of dragonflies were taken. The investigators located an area within Yellowstone where the number of different species numbered from six to eight. This observation goes counter to previous observations of, at a maximum, three different species per wetland inventoried. Investigators will be doing further research in this area in 2001. Several additional wetland areas will be inventoried in 2001. Damselfly species will be more of a focus as well in 2001.

Project title: The Mosquitos of Yellowstone National Park, a Study of Their Species and Biology

Principal investigator: Dr. Lewis Nielsen
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Objective: An ongoing study of the mosquito species to determine species present and their biology.

Findings: Park was not visited during 2000.

Project title: Assessment of Host Races in the Ovary-feeding Beetle, Brachypterolus pulicarius *(Coleoptera: Nitidulidae)*

Principal investigator: Dr. Robert Nowierski
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Additional investigator(s): Kelly Hering, Bryan FitzGerald

Objective: This research is being completed for Kelly Hering's Master's thesis project at Montana State University, investigating the existence of host races in the beetle, *Brachypterolus pulicarius,* a natural enemy of yellow and Dalmatian toadflax. Because this beetle exists on two separate host plants, researchers are investigating whether the species consists of two genetically distinct host races. In choosing sites to collect the insects and plant material, sites were sought where the insects have never been released as a biological control agent. Rather, they were accidentally introduced along with the weeds. Because *B. pulicarius* has never been introduced into Yellowstone, and because both yellow and *D. toadflax* infestations are present, the park offers an excellent opportunity for collecting the insects as they naturally occur on the two hosts. Along with the sites in Yellowstone, others in Canada and the northeastern United States will be analyzed.

Findings: In July 2000, Bryan FitzGerald and Kelly Hering again attempted to sample several toadflax sites. Five sites visited in 1999 were re-visited this year and efforts were made to collect insects and plant material. However, due to extremely dry conditions, no beetles were found at one of the sites. At the other four sites, a total of about 120 beetles were collected and about 10 toadflax stems were harvested. Beetles were either immediately placed into alcohol to be preserved for use in genetic analysis or were returned to campus alive to be utilized in behavioral trials prior to being preserved in alcohol. All insects collected were killed and will be processed during the course of genetic research. Behavioral trials were conducted utilizing a Y-tube olfactometer in an attempt to determine whether the beetles have a preference for the plant species they were harvested from. In 2000, no significant behavioral results were found. Genetic work has continued, and DNA extracted from B. pulicarius has been successfully amplified. Current efforts are being made to more effectively visualize Amplified Fragment Length Polymorphism (AFLP) products for genetic anlysis of intra-specific variation in the samples.

Project title: Birds, Bees, Butterflies, and Botany

Principal investigator: Mrs. Peg Steuneuberg
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Objective: To teach students various scientific illustration techniques for rendering insects, birds, and botanical material.

Findings: None

Project title: Respiratory Physiology and Habitat Selection in Thermophilic Aquatic Insects

Principal investigator: Dr. Brent Ybarrondo
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Objective: Understand respiratory physiology and habitat selection decisions in thermophilic aquatic insects including water scavenger beetles *(Coleoptera: Hydrophilidae)* and both adult and nymphal stages of dragonflies and damselflies *(Odonata)*. Correlate habitat selection decisions and thermal preference with respiratory physiology and development *(Odonata).*

Findings: Adults of two species of dragonflies partition habitat riparian habitat along the Firehole River in a manner suggesting that water temperature and/or dissolved oxygen tension may be determining factors related to oviposition and/or niad development. Males of each species defend territories, in which females oviposit, that differ significantly in water temperature and dissolved oxygen. Odonate niads from thermal pools have been found to exhibit thermal preference in the laboratory, suggesting that temperature may be an important determinant of development time in these insects. Hydrophilid respiratory complex (plastron + macroplastron, or bubble) functions primarily as an oxygen reservoir at water temperatures greater than ca. 5C. Adult beetles have been collected from thermal pools during early winter and are know to overwinter as adults under thick ice in temperate ponds. Future research will investigate (1) the degree to which the respiratory complex function as a physical gill at low water temperatures (ca. Tw = 0 to 5.0C), (2) the degree to which adult male dragonflies exhibit thermal preference in controlling oviposition territories in thermally variable environment (e.g., Firehole Rive study site), and (3) development rates of odonate niads as a function of water temperature and dissolved oxygen tension will be investigated.